DOCUMENT RESUME

ED 211 020 HE 014 696

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TITLE Modeling with Microcomputers.
PUB DATE 29 Oct 81
NOTE 6p.; Paper presented to the Joint Conference of the Southern Association for Institutional Research and the North Carolina Association for Institutional Research (8th, Charlotte, NC, October 29-30, 1981).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Oriented Programs; Computer Programs; Higher Education; *Institutional Research; Management Information Systems; *Mathematical Models; *Microcomputers; Models
IDENTIFIERS VISICALC Program

ABSTRACT

The applications of a recently developed computer program for microcomputers in developing models in an institutional research environment are considered. The VISICALC program requires no user programming skills, is available for all major brands of microcomputers, and provides for easy exchange of information between users of different computing equipment. Computer modeling consists of the analysis of conditions or situations with the purpose of defining the essential elements, their interrelationships, and methods by which to relate the elements mathematically. After the relationships are established, various elements of the model can be manipulated to observe the changing outcomes. An example of modeling might be to develop a system that will provide tuition revenue estimates. By establishing a model of how tuition income is generated, one can observe the impact of changes in the variables that determine tuition income. The variables that control tuition income would be defined (e.g., full-time/part-time student mix, tuition rates, and college and school enrollments). Using the microcomputer, one can change the undergraduate enrollment figure and see its impact on expected income from tuition. VISICALC can take a problem that an individual would manipulate in a column-and-row format and transform it into a worksheet of up to 63 rows and 254 columns. Creating models involves typing headings and columns and entering formuli. VISICALC performs all arithmetic and transcendental functions and has a number of special functions. Background information concerning the origin of microcomputers is noted. (SW)

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Modeling with Microcomputers

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presented at

The Eigth Annual Conference
Southern Association for Institutional Research
Charlotte, North Carolina
October 29, 1981

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HE 014 694

Modeling With Microcomputers

ABSTRACT

Developing and implementing computer-based models for planning and research in higher education have historically been time-consuming activities which in most cases required significant amounts of technical expertise. The process of creating a model which takes advantage of the speed and accuracy of the computer can be a major undertaking. The development can include significant investments in computer programmer time, computer usage time, time to learn how to use one of the various simulation packages, or the purchase and/or lease of madeling software available from some other computing facility. Even after all this investment, the ease of entering baseline data or changing some parameters to see "what if..." could be a frustrating exercise. A need seems to exist for a way to more easily and less expensively develop computer-based models for use in planning and analysis.

The recent development and marketing of a computer program for microcomputers may have provided a way to reduce much of the burden and technical expertise previously required in model building. This program was designed for use in accounting practices but it's capabilities in the area of forecasting make it well suited for generalized modeling. The program requires no user programming skills and was designed for easy parameter manipulation for instant analysis of alternate strategies. Additionally, this program is available for all major brands of microcomputers, and provides for easy exchange of information between users of different computing equipment.

This paper will illustrate some of the uses of this computer program for developing models in an institutional research environment. Several working models will be illustrated. The limitations and potentials of the use of microcomputers for modeling will be discussed.

For most institutional research offices, preparing plans is part of the job. Estimating future enrollments, projecting demands for specific programs and forcasting revenues, are all tasks which we might be asked to perform. The analyses involved may range from simple calculations to the development of a complex "model" in which many elements interact.

The tools to help us in the performance of these types of analyses have existed since the 1960's when computerized planning models first appeared. These original planning aids were sophisticated computer programs built to run on large "main-frame" computers. Because of the costs involved and the equipment required, these systems were mostly used on the large university campuses. As time-sharing of computer resources became more readily available these programs were available to many more institutions but the costs for disk space and terminal rental still left many planners in need of an aid to model building.

Origin of Microcomputers

In the late sixties a revolution began in the micoelectronics industry. The memory and logic components of computing equipment were experiencing enormous reductions in size and concomitant increases in their speed. Coupled with falling production costs the result of all of these changes was smaller, faster, less expensive computers. A major breakthrough occured in 1979 when all of the major elements of a computer were combined and implemented on a single integrated circuit "chip". With this device plus some memory circuits the microcomputer was born (1).

In less than ten years the microcomputer industry has experienced unprecedented growth. The microcomputer has advanced to the sophistication of some of the computers that were among the best at the time it was first built, and a huge industry for manufacturing peripheral products for these computers has developed.

Originally, these microcomputers were purchased by electronic hobbyists. Soon their potential was realized and small "personal computer systems" began to appear. Following several years of erratic growth the industry was finally prepared to market a dependable product. At this point the "software" explosion occured in which computer programmers became entrepreneurs and began to develop programs for the micocomputers. Sophisticated programs began to appear for applications in education, engineering, manufacturing, and business.

As microcomputers evolved, the business community began to see how they might be useful to them. As a result, a number of innovative computer programs for business planning began to be marketed. Among these were several programs which were useful in developing and executing planning and analysis systems. These programs, because of their general nature, their unusual flexibility and ease of use make them excellent tools for the types of modeling that we do in institutional research.

Computer Modeling

Computer modeling consists of the analysis of conditions or situations with the purpose of defining the essential elements, their interrelationships and methods by which to relate the elements mathmatically. After the relationships are established, various elements of the model can be manipulated to observe the changing outcomes.

An example of modeling might be to develop a system that will provide tuition revenue estimates. By establishing a model of how tuition income is generated we can observe the impact of changes in the variables which determine tuition income.

We would first define the variables which control tuition income : full-time / part-time student mix, tuition rates, college and school enrollments, residency status and tution rates. Knowing the elements and their relationships will allow us to build a simple model which, by providing values for each of the elements, will estimate tuition income. We also now have the capability of changing any of the elements and testing "what if..." questions. For example we can change the undergraduate enrollment figure and see its impact on expected income from tuition.

A variety of models could be developed using similar methodologies for such applications as enrollment projections, tenure analysis, budget planning, staffing requirements, and many types of year-to-year comparitive analyses.

The simpler models can easily be developed with pencil and paper, but changing and re-calculating the results can be time-consuming. The development of more elaborate models would be even more dificult to manipulate and evaluate with reasonable speed. It is at this point that the capabilities of the microcomputer should be evaluated.

The model described above can be formulated, entered into the computer and be ready for simulation work in twenty to thirty minutes using a computer program called VISICALC (2). VISICALC is refered to in its advertisements as the electronic worksheet because it can take virtually any problem you would manipulate in a column-and-row format and transform it into a worksheet of up to 63 rows and 254 columns.

The author uses VISICALC on an APPLE computer, but the program is available for virtually all microcomputers. This cross-machine availability is one of the most useful of the product's attributes. If a model which has some general utility is developed by an author with one kind of microcomputer it's structure can be transferred to a colleague who owns a different type of microcomputer and it will still work (try that between IBM and DEC computers!).

Creating models with VISICALC is generally as simple as typing headings across the top of the columns and down the side of the page rows. When these headings are complete, formuli are entered into the row and column locations where there are to be calculations. The model results are instantly available and are displayed on the computer's video screen or can be sent to a printer.

Computationally, VISICALC performs all arithmetic and trancendental functions and has a number of special functions such as SUM, MIN, MAX, AVERAGE, INTeger, and ABSolute value.

There are also special functions which allow the user to format column output in floating point, integer, dollar-and-cents, left or right justification, or graph form.

While the program does have some limitations when developing extremely large models, there are at least two current alternatives: (1) Develop sub-models. The results of one model can be stored and passed to another model. (2) Use a program other than VISICALC. There are a number of other products which will develop large and highly complex models. Each of the programs in this family of model development tools has it's own specific positive and negative aspects.

Summary

The development of the microcomputer has made available dedicated computing power for the research analyst. The development of modeling tools for business applications has made available a new tool for institutional research.

These new computer programs for "worksheet analysis" offer the potential for reducing the drudgery and increasing the utility of many of the types of analyses which are performaed in our work every day. They are simple to use and they are capable of complex types of analysis. Their ease of use and adaptability to a wide variety of analytical problems demands that these new tools be given adequate review for incorporation into the technical toolbox of institutional research professionals.

REFERENCES

Litaker, R.G. The microcomputer: A New Resource for the Institutional Researcher. Proceedings of the Seventh Annual Conference of the Southern Association for Institutional Research, Louisville, Kentucky, October 31, 1980.

VISICALC. Distributed by Personal Software Inc. Sunnyvale, CA.